West Concord Village

# 3 Community Setting

**This section examines the regional context, history, and culture of Concord. It also looks at how Concord may need to adjust its conservation and recreation priorities to address the community's needs in the future.**

## A) Regional Context

Concord, the oldest inland town in New England, is located at the confluence of the Sudbury, Assabet, and Concord Rivers in a rolling terrain of glacial deposits. An outer Boston suburb with a rural feel, Concord's abundance of water resources have stimulated diverse development over time. Rivers, railroads, and road systems link Concord to surrounding towns and beyond, and have contributed to this agricultural, residential, and recreational development. However, extensive wetlands and strong efforts to preserve the rural, historic character of the town have limited development in certain areas, thereby protecting many of today's open space and recreation resources. Protection of the town's large natural areas is strengthened by conservation land in the adjoining towns of Carlisle and Lincoln. But, due in part to an affluent population and strong local economy, development continues to expand.

Because many, perhaps most, issues facing a town are strongly influenced by conditions in other towns, a broad perspective is essential for effecting planning, management, and policymaking. Nearby towns tend to have a greater effect than distant ones. Although working with nearby towns is relatively common, it tends to be on an issue-by-issue basis. In contrast, an ongoing regional perspective that addresses diverse issues without detracting from local control should greatly enhance problem solving and decision making.

Planning regions are normally delimited in one of two ways: either a state is subdivided into a set of familiar or historic regions, or planning regions are delineated based on distinctive common physical characteristics, such as a core area, a drainage basin, or certain boundaries. Assuming there are many towns in a region, many will lie near the border of another region and be affected by it. That is to say, the effects of one regional conglomeration of towns on neighboring towns outside of that planning region should not be discounted and must be included in planning discussions. For example, the "MAGIC subregion" (a multi-town issues-discussion forum created by the Metropolitan Area Planning Council) is a narrow slice of twelve towns including Concord and towns as far away as Bolton and Hudson, but not nearby Sudbury, Westford, Wayland, and several other towns with which Concord regularly interacts. A rounded region centered on Concord is quite useful for planning and provided an important perspective for the 2004 plan. Nineteen towns, including Concord, were identified as having some form of relationship that indicated a need for regional collaboration in that plan. For this 2015 Plan, the town-centered region was expanded to include Ashland, Hopkinton, Hudson, Marlborough, Northborough, Southborough, and Westborough. This expansion takes into account the fact that the headwaters of the two major rivers, the Sudbury and Assabet, that flow into and through the southern half of Concord both originate in Westborough and flow through at least a portion of the other towns.

Another familiar problem with a regional approach to planning is conflicting political and economic agendas. Land use issues are routinely handled at the state and local levels, and states and communi-

ties normally have strong governments and set taxes and budgets. Although regional planning authorities often play valuable roles, many have limited budgets, are sometimes seen as threats, and have finite lives. Therefore, this plan promotes a regional approach which: (1) retains "home rule" in the town; (2) recognizes a "town-centered region" composed of surrounding towns that have natural interactions with one another; and (3) recognizes the state planning process as a promising way to mesh the open space plans of surrounding towns.

Within Concord's town-centered region, ten major land uses significantly affect the town's open space, natural resources, and recreation: [2]

- Large natural vegetation areas, including wetlands;
- Major water-protection corridors along streams and rivers;
- Major wildlife corridors (away from water bodies);
- Special sites (small places) of open space importance;
- Walking/bicycling trails;
- Agricultural land;
- Residential land;
- Shopping, commercial, and industrial areas;
- Main roads; and,
- Air and rail transportation facilities.

Mapping of these land uses (many are mapped in this report) reveals spatial patterns of water, wildlife, and people movement across the region. The mapped patterns also provide clues to Concord's effects on its neighbors, and vice versa. Major positive or negative effects that each of these patterns has or could have on Concord's open space, natural resources, and recreation are listed in *Section 5*.

Mapping these patterns across the Concord region leads to insights unavailable from a town-only perspective. For example, Concord is a major part of two very large areas of natural vegetation bisected by Route 2, one extending into Carlisle and northwestward, and the other southward into Lincoln, Wayland, and Sudbury. The southern area of abundant natural vegetation is mainly linked to the Sudbury River Valley.[1, 50, 20]

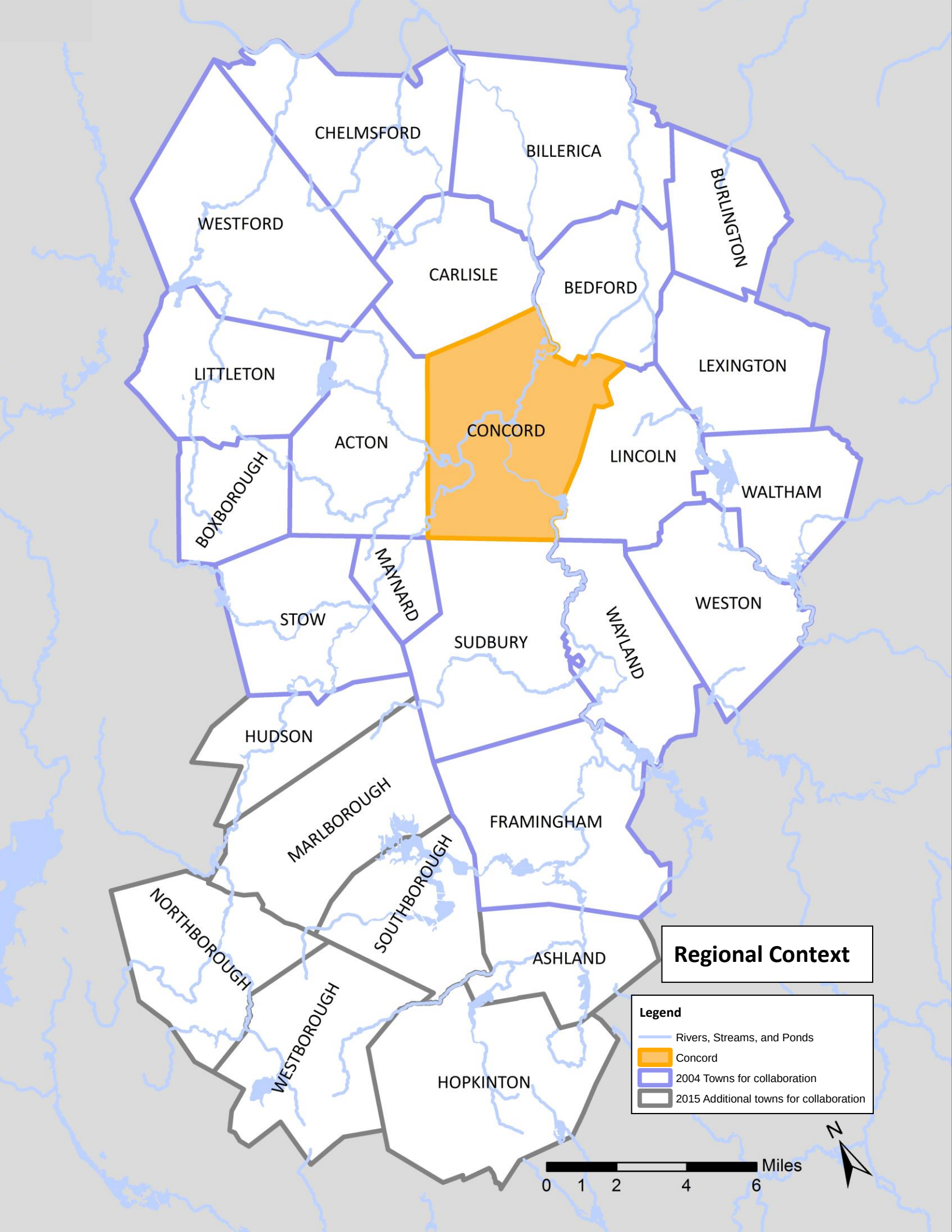
As climate change impacts (such as the northward migration of wildlife and plant species) begin to take hold, vegetation areas to the northwest in Carlisle, northern Acton, and southern Westford appear to have the only remaining south to north corridor between the Concord region and New Hampshire. To the north, east, and south, most outer towns of the region have little natural vegetation left and it is highly fragmented. Outer towns to the west have significant natural vegetation, but rather little is protected open space. Finally, very little natural vegetation, and still less protected open space, remains nearby in the adjacent towns around the southwestern quarter of Concord's perimeter.

In addition to understanding patterns across the whole region, it is important to understand the impact of flows and movements across the town boundary, in particular those wildlife, water, pollutant, and human movements that originate within about one mile of the boundary and move toward or away from Concord. Some conditions have known effects across the boundary while others bear watching over time. It may be necessary to work with adjacent towns and nearby landowners to prevent, eliminate, or minimize negative effects and strengthen or encourage positive ones. Adjoining towns sometimes acquire open space that connects with and adds value to Concord's natural vegetation and agricultural areas.

There are nine locations around the Concord boundary where major impacts now cross the border or may in the near future:

## Regional Context

Concord is a suburban/rural suburb located to the west of Boston. Because of the abundant water resources in Concord, it is important that the town works regionally to protect the watershed of the rivers that run through it. The 2004 OSRP highlighted 18 towns for collaboration (purple outlines, see regional Context Map on the following page) and seven additional towns (grey outlines) are proposed for this OSRP to include the headwaters of the Sudbury, Assabet, and Concord Rivers.


CHELMSFORD
BILLERICA
BURLINGTON
WESTFORD
CARLISLE
BEDFORD
LITTLETON
LEXINGTON
CONCORD
ACTON
LINCOLN
BOXBOROUGH
WALTHAM
MAYNARD
STOW
SUDBURY
WAYLAND
WESTON
HUDSON
MARLBOROUGH
FRAMINGHAM
SOUTHBOROUGH
NORTHBOROUGH
ASHLAND
WESTBOROUGH
HOPKINTON
Regional Context
Legend
Rivers, Streams, and Ponds
Concord
2004 Towns for collaboration
2015 Additional towns for collaboration
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- Southwestern corner by Acton;
- Where Route 2 and Nashoba Brook cross the Acton line;
- Estabrook Woods and Spencer Brook area by Carlisle;
- Concord/Bedford line near the Concord River;
- Hanscom Field area in the northeastern corner;
- Route 2 in the Crosby's Corner area;
- Walden Pond and landfill area by Lincoln;
- Sudbury River and Nine Acre Corner area by Sudbury, Wayland, and Lincoln;
- Sudbury/Concord town land near White Pond.

## B) History of the Community

The town originated in 1635 when English settlers arrived from Boston. Deforestation continued unabated until the mid-nineteenth century, reducing forest cover from perhaps over 90 percent to nearly as little as 10 percent. River corridors provided transportation, water resources, and wildlife. Agriculture, as well as industry on a limited scale, also expanded across the town up through the mid-nineteenth century, and agriculture remains viable today in at least five large areas (see Open Space Framework 2015 Map). In 1775 the American Revolution essentially began in Concord. In the early nineteenth century the town was a bustling commercial center with a county courthouse. The first railroad arrived in 1844, linking Concord to Boston. From about 1830 to 1880 Concord was effectively the literary center of America, where Ralph Waldo Emerson, Louisa May Alcott, Nathaniel Hawthorne, and Henry David Thoreau lived and wrote. Key wildlife was relatively scarce in the early part of the nineteenth century but began to rebound by the end of that century. During the twentieth century, the amount of agricultural land shrank, residential development spread, and the road network expanded. Population, the number of vehicles, and the frequency of commuting to the surrounding towns of Concord's region, as well as to Boston, grew enormously. A major highway corridor, Route 2, sliced Concord into two halves. In the second half of the twentieth century, land protection by federal, state, town, and nonprofit organizations resulted in a rich yet somewhat fragmented set of protected open space and recreation resources.[28, 31, 34, 35, 33, 49]

According to a Concord Historical Commission report that highlights natural resources and architecture over time, about ten large areas, especially those near water bodies, are of archaeological importance for Paleoindian, Archaic, and Woodland artifacts.[9] Six historic districts, many isolated National Register structures, Walden Pond, Minute Man National Historical Park, five large agricultural areas, and the abundant protected areas help define the town's special character.

## C) Population Characteristics

For more than a century, Concord's population grew quite slowly, from 1,564 in 1765 to 2,676 in 1875. Population growth picked up over the next 75 years, reaching 8,623 residents in 1950, and increased sharply over the 20 years after that: the town had 12,517 residents by 1960, then grew again by almost one third, to 16,168, in 1970, and in 2000 was 16,993.[15] Population growth has slowed, increasing just 3.97 percent in the past decade and as of 2010 there were 17,668 inhabitants. In its region, the town is near the median in population size at approximately 680 people per square mile.[15] Concord's zoning mirrors the distribution of the people in Town, with higher densities found within Concord Center, West Concord Village, and Thoreau Depot.

Concord's population is comprised of 87% Caucasian, 3.6% African American, 3.7% Hispanic American, 4% Asian American, and 1.7% Other. Eight percent of the population is foreign born. According to the Massachusetts Executive Office of Labor and Workforce Development in 2013, Concordians work in the following fields: Public Administration (7.3%); in Leisure and Hospitality (11.2%); Education (40.5%); Professional (19.3%); Finance (2.6%); Information (3.1%); Trades (9.6%); Manufacturing (1.4%); Construction (1.7%); Natural Resources/Mining (0.5%); and 2.8% classified as Other. In 2014, the unemployment rate was 4.4%.

Concord residents are aging, with the median age progressively increasing from 27.7 years in 1970 to 46.9 years in 2010, and with people aged 65 or older more than doubling from 8.6 percent to 20 percent of the population. Meanwhile children aged 0 to 9 gradually dropped from 18.8 percent to 10.4 percent over those 40 years.[15]

These demographic trends and several related patterns have diverse implications for Concord's open space and recreation planning. The gradually aging population highlights the need for increased accessibility of recreational resources (see Section 7). The decrease in percent of children, accompanied by an increase in organized sports enrollment, suggests maintaining existing playgrounds, playing fields and recreation facilities, while responding to changing types of recreation (see Section 7). House lot sizes and population

density have water, wildlife, and open space implications (as discussed below). Broad regional projected needs help focus recreational planning in Concord (see Section 7).

Median family income is relatively high at $129,646, and continues to rise as urban sprawl and commuting distance increases, while available land for development in town shrinks, and housing costs rise. Diverse employment (especially small commercial establishments, light industry, small businesses in office buildings, private schools, a hospital, and self-employed residents) is widely dispersed across the town. Private schools maintain some open space. New light industry periodically appears in areas zoned for this activity. Forestry is minor but agriculture is important in town. Finally, though population growth remains slow, the implications of climate change, oil demand, and other potential impacts related to current land use patterns will require vigilance, investment, and careful planning in order to maintain a successful balance of developed and undeveloped lands.

## D) Infrastructure

Concord essentially began with a mill, pond, and a cluster of buildings at its center, surrounded by forest. As farmland spread, open space provided agricultural products and water, game, and firewood. Later, as residential land with scattered woodland largely replaced the agricultural land, open space increasingly provided wildlife habitat, clean water, scenic value, intensive field-based activities, and recreational trails. These much-treasured resources, increasingly planned for and protected, help define and preserve the town's character.

Residential, commercial, and industrial areas provide structure to the Town and are shown as "built areas" on the map of the Open Space Framework (see Section 2)**.** Large built areas are the centers of living, shopping, working, and interacting for people. But even these built areas contain important open spaces within them: the small pockets of open space in the midst of developed areas contribute to the quality of life. These include playgrounds, town greens, and cemeteries, and, secondarily, scattered large lots and corridors of backyards aligned together. They include naturalized areas such as those set aside as part of residential developments at Moses Pond, Westvale Glen, and most recently at Monsen Farms.

The public water supply serves almost all residences and businesses in Town and does not limit development opportunity. In contrast, the town's sewer system serves less than one-third of the town, meaning that two-thirds of the Town have on-site septic systems. In Concord the sewer system has essentially followed, rather than stimulated, dense development. One active rail line remains in Concord, with the two train station locations established in the nineteenth century, to serve already existing nodes of development. Of this infrastructure, perhaps only the road system today has a widespread effect in defining and preserving the Town's character.

As discussed below, three types of infrastructure relevant to development and subsequent impact on open space planning include: transportation systems; water supply systems; and sewer and septic wastewater systems.

### D.1 Transportation Systems

#### D.1.a Roads

Throughout its history, Concord has been a hub with roads that have facilitated commerce and stimulated development. Today's road network provides access to all of Concord's open space and recreational resources, and disperses impacts on wildlife and water resources (e.g., by road salt and traffic noise). Route 2 sliced through the town in 1935, and today has a wide swath of impacts, including acting as a barrier to crossing by wildlife and pedestrians. The two periods of rapid road building in town were 1635-65 and 1930-90.[3] Concord maintains 107 miles of road (in 2013) and also contains 5 miles of Route 2, a major arterial highway. The total road miles figure includes arterial roadways (e.g., Laws Brook Road, Bedford Street), collector roadways (e.g., Harrington Avenue, Virginia Road), through streets (e.g., Church Street, Hawthorne Lane), and residential streets.

The highest average daily traffic volumes are (*in 2009*): Route 2 (*45,000 vehicles*); Main St. (*at Sudbury*) (*20,800*); (*in 2006*) Main St. (*west of Walden*) (*13,900*); Main St. (*east of Elm St.*) (*16,000*); Main St. (*at Baker*) (*13,000*); Old Bedford Rd. (*11,400*); Lexington Rd. (*10,100*); Lowell Rd. (*11,000*); Elm St. (*9,800*); Commonwealth Ave. (*10,500*); and (*in 2004*) Cambridge Turnpike (*6,200*). The town has 59 miles of sidewalks.[24]

The town has 17,000 registered vehicles, with two vehicles reported in 49 percent of its housing units.[26] From 2000 to 2010 the number of residents commuting to work dropped from 7,374 to 6,335 and the number who drove solo dropped from 5,665 to

5,242. Carpooling rose from 383 to 556 motorists, while commuting on public transportation rose (384 to 537 residents per day). The number of Concord residents walking to work or working at home remained about the same since the 2000 Census, decreasing from 876 to 875 residents. Average travel time to work for all commuters increased from 28.5 to 29.5 minutes during the past decade.[15]

Walking and bicycling for work, shopping, and social interactions can help alleviate transportation issues related to climate change. Yet the proportion of such trips could grow noticeably with modest changes that make walkways and bicycle routes (including those on town roads) safer, more convenient, and more appealing. Reducing vehicular traffic or traffic growth would yield benefits to water bodies, wildlife, recreation, and open space. Water bodies would receive less runoff with traffic-caused pollutants. Wildlife would be less likely to be killed by vehicles or stressed by traffic noise. Improving walking and bicycling routes for transportation would also stimulate their recreational use. Reducing the number of cars on the road would also reduce the town's carbon footprint and help mitigate climate change. Low impact access to the town's open spaces would be enhanced, with associated opportunities for bird watching and nature appreciation. These cumulative benefits should translate into increased stewardship of neighborhood open spaces and natural resources by residents.

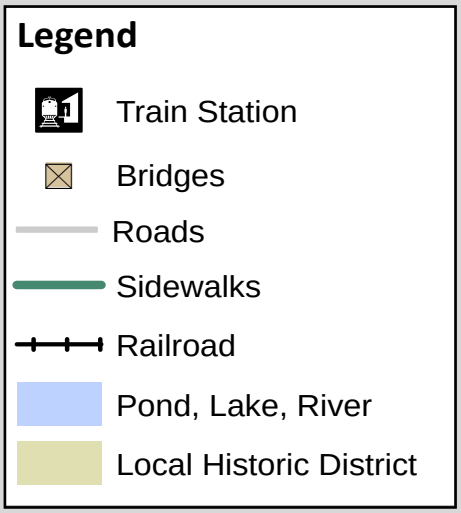
In 1999, the Concord Transportation Plan Committee recommended that the Town make a long-term commitment to traffic calming and management as an alternative to the traditional approach of meeting demand by increasing capacity. Traffic calming is accomplished with solutions involving signs, lane widths, intersection enhancements, road-surface markings and structures, parking adjustments, and other modifications that favor walking and/or bicycling. One goal of such efforts is to minimize cut-through traffic on local roads and decrease traffic volumes in major downtown areas. The committee urged the town to work on this problem in cooperation with other communities.

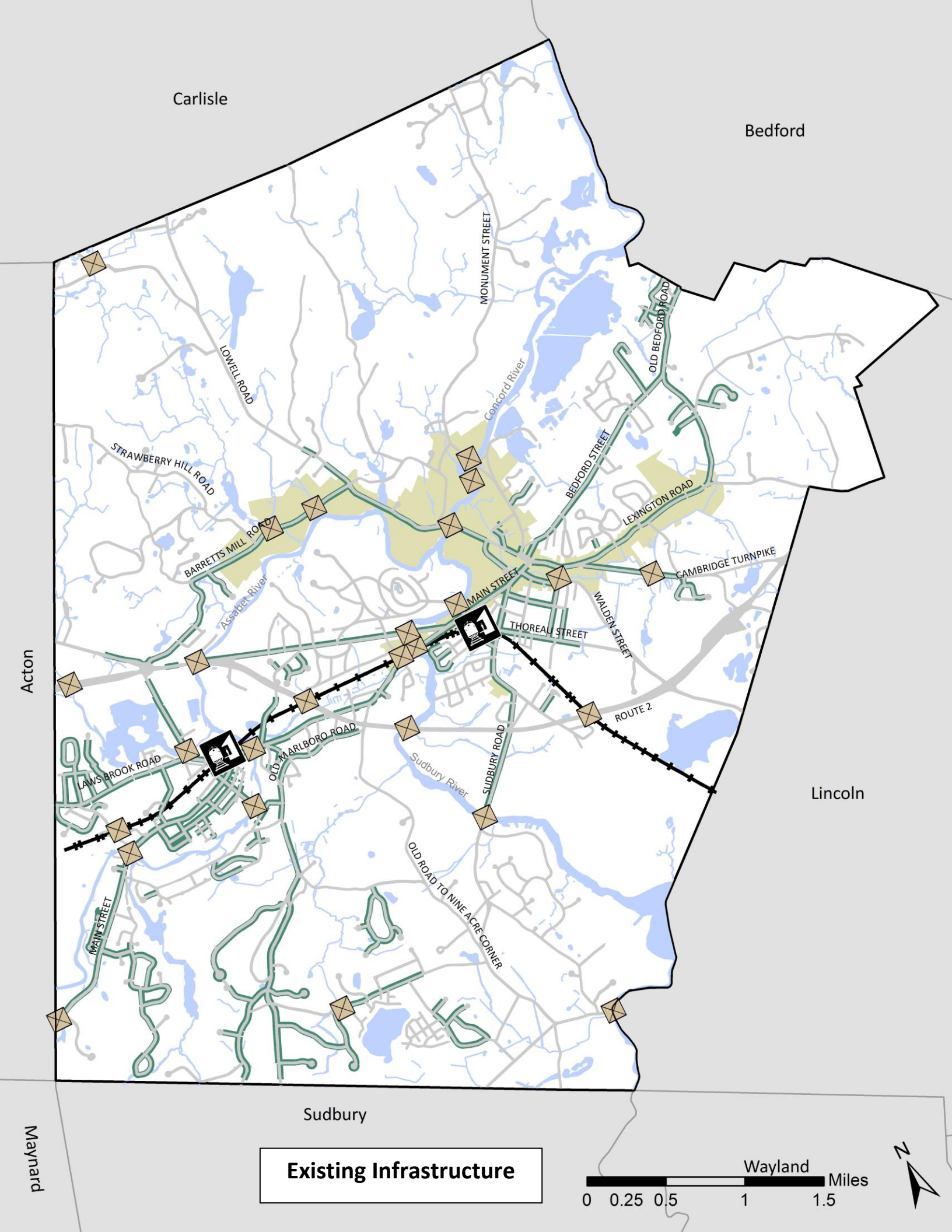
Traffic calming provides benefits to wildlife, water, recreation, and people. A wise adage says: "Design a community for 7 year-olds and 70 year-olds." A step towards accomplishing this includes making the roads of Concord pleasant and safe for walking, bicycling, children, and the elderly, which strengthens neighborhoods.

## Existing Infrastructure

Concord is bisected by Route 2, has two train stations for a commuter train to Boston, 25 bridges, 107 miles of road, and 59 miles of sidewalks. Route 2 presents challenges to crossing for humans and wildlife. Despite having two train stations in town, the majority of commuters still use their cars to get to work. Bridges can become flooded and block emergency access during flood events, which may become more frequent with climate change. Widening bridges would improve wildlife corridors on riverbanks.

West Concord Train Station




Carlisle
Bedford
Acton
Lincoln
Sudbury
Maynard
Wayland
MONUMENT STREET
LOWELL ROAD
Concord River
OLD BEDFORD ROAD
BEDFORD STREET
STRAWBERRY HILL ROAD
LEXINGTON ROAD
BARRETTS MILL ROAD
CAMBRIDGE TURNPIKE
Assabet River
MAIN STREET
WALDEN STREET
THOREAU STREET
ROUTE 2
LAWS BROOK ROAD
OLD MARLBORO ROAD
Sudbury River
SUDBURY ROAD
OLD ROAD TO NINE ACRE CORNER
MAIN STREET
Existing Infrastructure
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Miles
N

To this end, improvements were made to increase circulation at Monument Square (the rotary in the town center) and at Concord Academy. The Cambridge Turnpike Improvement Project seeks to develop and implement a comprehensive plan to improve the many problems affecting the roadway from Lexington Road to Routes 2 and 2A. While the primary focus of this project is to address the existing flooding conditions that result in frequent road closures, flooding of homes and businesses and impacts to their septic systems, other design priorities will address environmental impacts, traffic safety and congestion, roadway width, historical preservation, and aesthetics. The town regularly collaborates with MAGIC, the regional planning committee, which has a transportation component called the MAGIC Mobility Transit Study. As a general rule, the Town continues to incorporate traffic calming management techniques.

Routes for rail travel, driving, bicycling, and walking across the region show quite different patterns (see Existing Infrastructure and Trail Maps). Interstate 495 is a major barrier for wildlife dispersing from the northwest into the Concord region, and as previously noted, with shifting climate patterns, will continue to serve as a barrier for east to west species migration.

### D.1.b Major Highway, Route 2

Four-lane Route 2, with about 45,000 vehicles passing each commuter day, slices not only Concord, but also the entire region, in half. Concord's network of highways and large areas away from highways is relatively similar to the pattern in adjacent towns. Concord residents benefit from Route 2 as a commuting and travel route, but the highway inhibits walking for residential and shopping purposes and blocks recreational walking routes. Residents must cross it often, but rarely easily, as they travel about the town. Route 2 traffic jams consistently create bottlenecks for commuters and through-travelers. No one walks or bicycles along the highway, and crossing at intersections can be challenging. Vehicle accidents are a concern and occur more frequently on Route 2 than other roads in Concord.

Route 2 traffic is the major source of noise in town, annoying to nearby residents and audible for a mile or two. The noise also degrades songbird habitat for surprisingly wide distances.[33] Vehicle emissions pollute the air and soil. The busy highway inhibits wildlife movement, both in daily foraging and in dispersing to new home ranges. This effect is worse where there are impenetrable concrete jersey barriers; road-killed animals are a frequent sight. In addition, the road is a concentrated source of road-salt, which accumulates in Concord's slow-moving groundwater. In short, the environmental and human impacts of Route 2 in Concord require mitigation.

Appropriate design methods have the potential to enhance wildlife, increase noise abatement, provide easier crossings for pedestrians, and ultimately ease traffic congestion in Concord's neighborhoods. Any improvements or upgrades should take an environmentally sensitive approach by aiming to restore or enhance the natural processes and biodiversity affected by this five-mile stretch of highway.

A significant effort to address congestion and safety concerns related to Route 2 is the realignment project currently under way at Crosby's Corner. Construction began in March 2013 and is anticipated to extend into 2016. The purpose of this project is to provide safety improvements at Crosby's Corner (intersection of Route 2, Cambridge Turnpike and Route 2A/ Concord Turnpike). This will be accomplished by constructing neighborhood service roads and a Route 2 flyover to carry Route 2 above other travel lanes. The benefits of the project include the ability to safely and efficiently accommodate traffic and to provide safe access to the residences and businesses along the project corridor. The project starts at the Bedford Road intersection in the Town of Lincoln and extends to 300 feet west of Sandy Pond Road in the Town of Concord.

Efforts to improve wildlife passage along Route 2 are also important aspects of town planning. The 2004 Open Space Task Force recommended several wildlife underpasses, porous median barriers, and one wildlife overpass to aid free movement of key wildlife between the two halves of town, split since the 1935 construction of Route 2. When carefully designed for animal behavior, wildlife passages facilitate crossings of highways for critical foraging and dispersal.[33, 36] Fences and walls can be used to block some animal access to highways, though care is important not to further divide severed communities or degrade aesthetics. Fences and walls against animals are appropriate only where sufficient numbers and sizes of underpasses, tunnels or pipes are provided to permit ample movement between opposite sides of the highway. Also, effective escape mechanisms are essential for animals that inevitably get on the highway sides of fences. Since the *2004 Open Space Recreation Plan*, two wildlife underpasses have been built along Route 2 and a third is under construction.[59]

Soil banks or raised soil berms along a somewhat depressed highway are effective in reducing traffic noise that has degraded nearby wildlife habitat (and residential areas). Reducing use of road salt or using ecologically suitable alternatives will reduce salt accumulation in groundwater and its effect on vernal pools, streams and ponds. Residents have expressed concerns about the overuse of salt on the roads, and road and sidewalk salt application procedures should continue to be evaluated as technologies change to minimize impacts. Lengthening bridges somewhat is also recommended, not only to overcome constricted-water-flow effects on river conditions, but also to provide adjacent floodplain strips under a bridge for wildlife movement.

Finally, overpasses or underpasses for walkers, shoppers and hospital access are important to reconnect the two split halves of town, particularly by Main Street and Emerson Hospital. Similarly, overpasses or underpasses are also needed for diverse recreational users in Concord, most critically at the intersection of Routes 126 and 2 and near Nashoba Brook by the Acton line. The Board of Selectmen requested that MassDOT include both the Bruce Freeman Rail Trail, which utilizes the Nashoba Brook wildlife corridor, and the old railroad crossing in its designs for a new Route 2 rotary, and both of these were included in the design for the Route 2 rotary. Currently, the rotary project has been put on hold. The Bruce Freeman Rail Trail has been separated from and is moving forward without the rotary project which will include an overpass at the Acton/Concord town line.

Specifically, solutions should be implemented to address the four major Route 2 issues that involve Concord's open space, water, wildlife and recreation. Noted below are relevant locations (from east to west) along the highway where special attention is warranted.

A) Underpass/overpass structures and porous barriers for wildlife crossing.

- Deep gully opposite Crosby's Pond;
- Eastern or central portion of the former landfill for a proposed wildlife overpass (perhaps compatible with a path for walkers) connecting the Walden Pond area with Brister's Hill and Town Forest;
- A wildlife corridor near the Acton line where Nashoba Brook crosses and is joined by Fort Pond Brook.

B) Vegetated soil banks and berms to reduce traffic-noise.

- Landfill area to the Route 126 area where the highway could be slightly depressed, together with soil banks or berms, to reduce traffic noise toward Walden Pond and the high school; and
- Raised highway causeway over Sudbury River floodplain where traffic noise presently carries especially far.

C) Changes to bridge, culvert, causeway, and road salt use that will reduce stress on rivers, streams, and groundwater.

- By Crosby's Corner, the Mill Brook from Lincoln is blocked and diverted to a culvert, and a state road salt/sand supply leaks salt into Mill Brook and groundwater;
- West of Route 126, vernal pools in Walden Pond State Reservation may receive road salt in groundwater;
- The highway causeway by the Sudbury River blocks frequent floodwater flows and accelerates river scouring;
- Between Baker Avenue and Assabet Avenue similar effects occur by the Assabet River; and
- By the Acton line, road salt, sand, and floodplain blockage impact Nashoba Brook.

D) Passages and other safety measures for pedestrians and recreational passage.

- At the landfill area, a wildlife and pedestrian overpass could connect trails in the Walden Pond area and Town Forest area, as well as the Bay Circuit Trail;
- At Route 126, an overpass for pedestrians and cyclists would increase safety and recreation by avoiding highway traffic;
- At Emerson Hospital, walking across the highway may land one in the emergency room;
- Main St. (Route 62), another logical walking route for residents, is also dangerous; and finally
- At the Acton line, the proposed Bruce Freeman Rail Trail will need to cross over the highway.

### D.1.c Public Transit

Public transport is another related mechanism to reduce traffic and achieve benefits to water, wildlife, climate change mitigation, and open space. Concord is unusual in being endowed with two commuter-rail stations connecting residents to

neighboring towns and the metropolitan region. Limited bus and van services are also part of the public transport system in Concord. Transit-oriented development guidelines emphasize the value of focusing growth within a half-mile (a 10-minute walk) of public transport centers, the typical maximum distance that people will walk for transportation.[14, 17] Therefore providing convenient, safe, and appealing walkways near stations is important for success.

Rail corridors penetrate the northernmost and southernmost towns of the region, in addition to cutting on a northwest-southeast axis across from Waltham to Concord to Littleton and beyond. Commuter trains on these rail lines facilitate travel, at least radially to and from Boston, and slightly reduce traffic and its ecological effects. Some wildlife cross Route 2 in railroad underpasses in Concord and Littleton, and moose may cross under the I-495 barrier in Littleton along the rail line. Many wildlife use the recently-constructed wildlife underpasses under Route 2. Major power-line corridors are also likely to be important wildlife corridors in the region.

### D.1.d Air

Hanscom Field on the corner of Bedford, Lexington, Lincoln, and Concord is the only major airport in the region, and its flight paths nearby are frequently characterized by considerable aircraft noise. Small private planes also use Erikson Field in Stow.

### D.1.e Corridors

Human corridors include the primary and secondary road system, rail lines, gas and power lines, canoe routes, bicycle routes, and walking trails. They typically interconnect to form networks with loops and entrance/exit nodes. Most of the network types are spatially separated based on location, infrastructure requirements, and safety concerns.

Human corridors provide efficient transportation routes for goods and people. Recreation routes channel people through an area of interest and between points of interest. The corridors provide for human movement across, in, and out of town. Loops provide alternative movement routes and recreational round trips. Channeling people through corridors also helps protect farmland and the large remote areas of natural vegetation.

As many people enjoy the town primarily from their cars or from the train, the views from Concord's roads and railway line are important elements of the town's open space. Maintaining the rural character of the town includes preserving those viewscapes that convey a sense of the town's agricultural and natural heritage.

## D.2 Water Supply Systems

Concord was provided with legislative authority to establish a public water system in 1872. In 1874, water from Sandy Pond in Lincoln began flowing through the original network of water mains to Concord center. Today, the water system has evolved to include six groundwater and surface water sources (see Public Water Supply Map), seven pumping stations, two treatment facilities, and a high pressure water main network consisting of over 130 miles of pipe.

The 1974 Annual Town Meeting established the Water Fund. Expenses for the water system are covered entirely by user fees. The Water and Sewer Division of Concord Public Works is responsible for managing the day-to-day operations of the water infrastructure. There are presently 5,511 customers receiving potable water service and fire protection from the Town water system. This represents approximately 95 percent of Concord residents and businesses, along with a small number of Acton properties located on Route 2A. In case of emergency, Concord is able to receive from or supply water to the neighboring towns of Acton and Bedford (via water main interconnections).[24]

Water conservation efforts to reduce overall and peak day demand are central to Concord's water supply strategy. The Water and Sewer Division continues to offer a variety of programs to support and encourage wise water use. After implementing a comprehensive water conservation program in 2002, Concord has reduced its total water demand by over 100 million gallons a year, average and peak water day demand by close to 1 million gallons per day, and residential per capital demand by over 10 gallons per person per day.

Water withdrawals in town may impact water quality and quantity in streams, water levels in ponds, vernal pools, and wetlands, and in aquatic ecosystems close to withdrawal locations. Water withdrawals are not limited to public water supply, but include private wells used for drinking water and irrigation. Agricultural withdrawals primarily associated with crop irrigation also influence groundwater and surface water levels.[24]

Water-monitoring data have been collected for the Assabet River, and, in a more limited manner, for a few wetlands and ponds, but no systematic study of

these widespread, important surface waters or aquatic ecosystems has been done. Conducting a water quantity and quality survey of Concord surface waters would provide an important baseline for the Town to evaluate future development. Also, in the face of continuing urbanization within and around Concord, continuing open-space protection near well sites remains a wise investment.

## D.3 Sewer and Septic Wastewater Systems

About 65 percent of Concord households have septic systems, most of which predate the rigorous standards required by the state's Title 5 regulations.[58, 3] Thus wastewater from most households drains into septic tanks, underground pipes, and groundwater in yards across the Town. The water supply is designed to meet peak seasonal demand periods that can exceed 4 million gallons per day during the summer. Total water demand for 2012 was approximately 750 million gallons (mg), which represents an average daily demand of 2.04 mg and residential per capita consumption of 68 gallons per day.[24]

Surface waters such as streams and ponds are fed, indirectly, by groundwater. With proper operation and maintenance, organic matter with associated pathogens (e.g., *E. coli*) in household wastewater is effectively treated by septic systems, before reaching surface waters. Also, with appropriate travel time through soil, mineral nutrients (especially phosphorus and nitrogen) in wastewater may also be diluted within the groundwater system, prior to being released into nearby surface water systems. Importantly, septic systems (and to a certain extent, neighborhood treatment systems) offer the only way to effectively recharge water locally.

However, with old or malfunctioning septic systems, the organic matter and mineral nutrients are more likely to reach and impair the town's streams and ponds. Furthermore, with increased development adding new septic systems across the town, increasing amounts of impurities may reach these surface waters. Septic organic matter reaching surface water can lead to a reduction of oxygen in ponds and streams that not only impart nuisance odors but could result in the loss of sensitive fish populations. Excess mineral nutrients, especially phosphorus and nitrogen, from septic wastes can increase the rate of eutrophication and degrade associated aquatic ecosystems.[24]

Concord was provided with legislative authority to create a municipal sewer system in 1894. By early 1900 a small, centralized collection system was constructed, carrying wastewater from Concord center via a network of gravity mains to a collection chamber located at 141 Keyes Road where it was then pumped to a cluster of filter beds located approximately one mile away on fields located adjacent to Great Meadows. Over the years, service needs and treatment goals have evolved, resulting in a series of collection system expansions and treatment system improvements. As of 2012, the sewer system serves over 1,830 accounts (35 percent of the community) and consists of 33 miles of collector mains (gravity and low pressure), two pumping stations, six neighborhood lift stations and a tertiary treatment facility. The tertiary wastewater treatment facility was upgraded in 2009 and performs very well under a variety of flow conditions. The facility is able to remove more than 95 percent of the biochemical oxygen demand (BOD) and total suspended solids (TSS), 99 percent of pathogens (via UV disinfection), and reduces phosphorus to levels well below 0.2 milligrams per liter—utilizing a luminary (first of its kind in the world) treatment process identified as Co-Mag.[24]

The municipal system primarily serves residential and commercial properties from the Thoreau School/Warner's Pond area eastward in the Park Lane, Emerson Hospital, Southfield Rd., High School, and Concord Center areas. A federal and state issued National Pollution Discharge Elimination System (NPDES) permit system currently limits the treatment capacity of the municipal wastewater system to 1.2 million gallons per day. Infiltration of groundwater into the system through leaking sewer pipelines, manholes, and perhaps unauthorized connections reduce the capacity of available service. Although actively addressed by Concord Public Works, this remains a problem. In 2004, the Town adopted a 20-year comprehensive wastewater management plan. The plan was developed in response to regulatory requirements imposed when the treatment plant reached 80 percent of its permitted capacity. The plan identified wastewater needs required to serve existing neighborhoods that had been waiting since the 1980s for town sewering, prioritizing such areas based upon long-range environmental, public health, aesthetic, and financial benefits. The recommended plan identified solutions for nearly 1,000 parcels, about half of which were identified as having a high probability of needing an alternative form of wastewater management, instead of a (Title 5) septic system. Approximately 75 percent of the parcels in the recommended plan would

be connected to the existing centralized sewer system, which now serves approximately 30 percent of the town. Most of the parcels proposed for sewering are located in the Elm Brook and Hawthorne Lane areas of town, West Concord, and near the Concord Country Club. Based on geographic settings, remaining parcels in the plan were proposed to be served by one of two neighborhood or "package" treatment systems: one to serve the White Pond area and one for the Conantum area, both being concentrated residential areas. Acquisition of municipal land for these package systems may be required. In 2003 and 2004 Town Meetings, the voters (and later the state) approved the first steps of the plan.[24]

In addition to the municipally sewered areas, several smaller-scale sewer collection and treatment systems exist which have been designed to meet the wastewater treatment needs of larger private entities. Three of the more notable package treatment facilities are associated with the Massachusetts Correctional Institution, which discharges to the Assabet River between Nashoba Brook and Route 2, the Middlesex School, which drains to Spencer Brook, and the 350-unit residential development Concord Mews, located on Nathan Pratt Drive, which is discharged to a state-approved groundwater discharge site.[24]

The Town tests drinking water for coliform bacteria and other public health threats, and the results are typically good. Surprisingly little is known about water quality (including septic pollutants) in aquatic ecosystems across town. Sustained systematic data exist for the Assabet River, White Pond, and Walden Pond. In 2003, two of the five swimming beaches in Town (on Kennedy's Pond and Silver Hill Pond) had to be temporarily closed due to excessive levels of *E. coli* bacteria, which is typically associated with septic leaching.[24]

Otherwise, mostly scattered or anecdotal evidence of intensely green water (perhaps mainly eutrophicated by phosphorus, such as at Warner's Pond and Moses Pond), blackish seepage, or odor suggests possible septic-caused pollution. Since 1995, when state septic regulations became tougher, 12 percent of the septic systems inspected by the Town have failed, while 6 percent received only a conditional pass.[3] These observations suggest that some small surface-water bodies near septic systems in town are likely to be polluted, especially during dry periods, with consequent effects on fish and aquatic ecosystems. Careful sampling of streams and ponds across town for water-quality characteristics, such as phosphorus/nitrogen/chlorophyll, BOD, *E. coli*, turbidity, salt, and toxic substances, is needed to evaluate this concern and to provide a baseline for evaluating future land use changes.

## E) Development

Several topics important to open space and recreation resources are presented here including: housing; land use patterns; municipal lands of particular conservation or recreation importance; and the ecological basis for concentrating and limiting development. The ongoing mix of proposed new houses and upgrades has its own low-level dispersed impact across the town.

Since the 2004 Plan, Route 2 has been widened, and median and peripheral barriers installed to increase safety measures and enhance capacity for through-traffic at somewhat higher average speed. Concerns over cut-through traffic still exist. Discussions about local traffic crossing the highway, traffic noise, and overpasses for crossing by local people, recreational walkers, and wildlife continue. Two effects of the planned sewer expansion on open space are potentially important. First, local water quality and aquatic ecosystems in and near the affected areas may improve somewhat. Second, the proposed large natural area, Jennie Dugan Kames, will be largely converted from septic to sewer wastewater treatment, with consequent long-term potential to stimulate development. However, neither project has commenced to date.

### E.1 Housing

The total number of housing units in town grew from 4,440 in 1970 to 6,636 in 2010.[6] The average number of persons per household progressively decreased from 3.6 to 2.68 during the last four decades.[15]

Since the mid-1990s, the number of available building lots and the number of persons per household has decreased, more of the population is retired and/or elderly, and the affordability of the existing housing stock has decreased. Additionally, the phenomenon known as "mansionization," the building of very large houses to replace smaller ones, has increasingly become an issue. Such large houses often have large septic systems, large lawn areas, large paved areas and outbuildings, which impact Concord's finite natural resources.

### E.2 Land Use Patterns

As of 2001, approximately 38 percent of the Town was developed land. This figure has changed little over the past decade. An average of 21.4 new lots per year were created in the decade 1990-99 (mainly by

subdivision, planned residential development, and "approval-not-required"), and an average of 23 new housing units were built each year. In contrast, protected open space increased markedly over the same time frame. Uncommitted land decreased an equivalent amount.

The distribution of today's protected open space across the Town at first glance mimics a "crazy quilt" (see Section 5). A closer look reveals an impressive, though ragged and incomplete pattern. Large aggregations or patches of protected land approximate and form the core of the large natural areas and some large agricultural areas of the Open Space Framework (see Section 2). For each large area, only a few high-priority parcels remain to be protected to complete the Town's open-space pattern.

The diversity of protected-land ownership means that accessibility and management practices vary widely. For instance, land has been protected through Town and land trust acquisitions, through Conservation Restrictions (see Section 5), and through Agricultural Preservation Restrictions. In addition, private landowners have enrolled in state programs, under M.G.L. Chapter 61, 61A and 61B, whereby they receive reduced property taxes for managing their land for forestry, agriculture, and recreation, respectively. Though not permanently protected, in return for the tax reduction, the Town has right of first refusal when these properties are sold. This allows a greater opportunity for diversity of habitats and recreational opportunities. Yet multiple ownerships also present challenges for coordinated land management of large protected natural and agricultural areas (see Appendix C*)*.

Over a quarter of the Town is "uncommitted land," that is, neither developed nor protected (see Section 5). Strategic places remain to be protected as conservation land.

Zoning was enacted in Concord in 1928. Recognizing this, Town Meeting has frequently approved additions and amendments to the Bylaw, especially in 1972, 1977, 1987, and 1992, and has passed at least one zoning bylaw amendment every year since 1994. Some noteworthy  Zoning changes since 2004 that impact open space include:

Section 10.2.9 Common Open Space (in Planned Residential Development (PRD)): (1) must comprise at least 25 percent of the total area of the PRD tract; (2) at least 50 percent of common open

Aerial View of Concord, 1938

Aerial view of Concord, 2008


Concord's population rose dramatically after WWII, and nearly doubled by 1970. The larger population meant building more houses (see orange arrows above). In part because of early conservation efforts that started in the late 1950s, many natural and agricultural areas in the town have been preserved (see blue and purple arrows, respectively). Continued conservation efforts and careful planning are necessary if Concord wants to maintain its rural feel and stave off mounting development pressures.

space must be upland area [Note: Common open space does not include yards, patios, or gardens for exclusive use by residents.]

Section 7.6 Groundwater Conservancy District was extended and Section 7.2 Floodplain Conservancy District was amended in line with 2014 FEMA mapping.

Section 6.2.2 Minimum Lot Area – definition was clarified so that at least 50 percent of minimum area required for zone is upland – this most probably results in larger lots, as resource areas can only partially be counted towards lot area requirements.

The Town's "Zoning Map" focuses on the zoning districts but also refers to various water-related and wireless communication areas. Dimensional regulations are specified for the zoning districts. The principal uses provided for are: extensive; residential; institutional; governmental and utility; business; industrial; and restricted and prohibited. Also many accessory uses, several special provisions, and three types of grouped residential buildings are delineated in the bylaws.

Zoning districts, laid out in an earlier era, do not correlate well with today's understanding of natural resources, including threats and needs for clean water, wildlife, agricultural land, recreation, open space, and other town objectives. A more in-depth zoning revision based in part on the Open Space Framework would serve the Town well, in providing a tool for future planning.

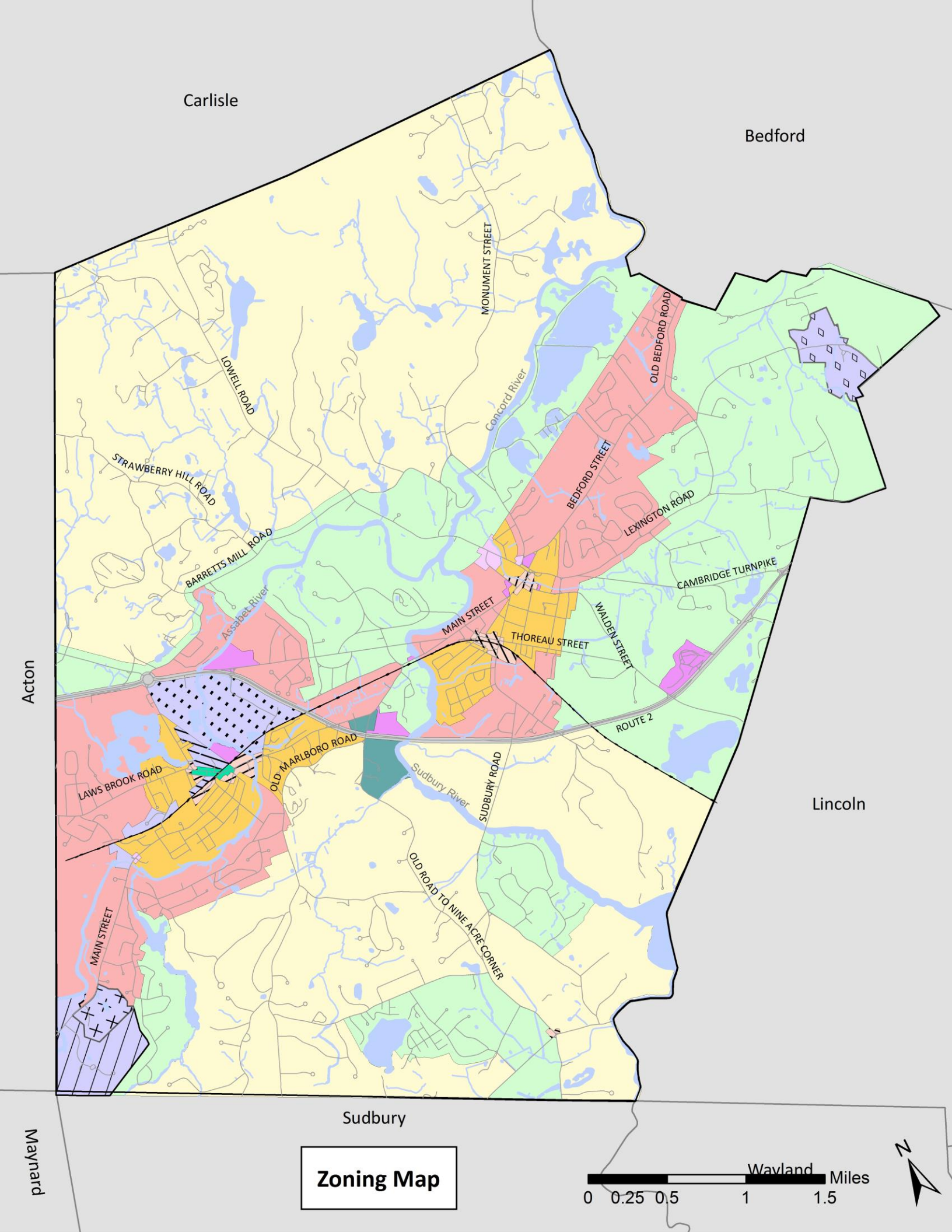
While present protection status, state environmental regulations, and town zoning constraints inhibit development on certain parcels, many lands in Town are still vulnerable to future development pressures. Specifically, the Town would do well to consider unprotected parcels without these constraints that lie within the natural areas, agricultural areas, and corridors identified in the Open Space Framework as priority lands for protection. If all of these parcels were developed, the integrity of these environmentally sensitive areas would be compromised and serious impacts on ecological, open space, and recreation resources could result. The corresponding degradation of the integrity of the Town's open space network as a whole would be expected.

Local effects of a maximum build-out would also

## Zoning

The majority of the land in Concord is zoned residential. Changes to the Zoning Bylaw could help shape future development patterns in Concord.


Concord Riverwalk, an example of a Planned Residential Development


Carlisle
Bedford
Acton
Lincoln
Sudbury
Maynard
Wayland
MONUMENT STREET
LOWELL ROAD
Concord River
OLD BEDFORD ROAD
BEDFORD STREET
LEXINGTON ROAD
STRAWBERRY HILL ROAD
BARRETTS MILL ROAD
Assabet River
CAMBRIDGE TURNPIKE
MAIN STREET
THOREAU STREET
WALDEN STREET
ROUTE 2
OLD MARLBORO ROAD
LAWS BROOK ROAD
Sudbury River
SUDBURY ROAD
OLD ROAD TO NINE ACRE CORNER
MAIN STREET
Zoning Map
0 0.25 0.5 1 1.5
Miles
N

include the loss of opportunities to establish small neighborhood public open spaces and the degradation of some Special Sites (see Section 5), pollution of water bodies, loss of wildlife and its habitat, more threatened rare species, and loss of future opportunities for enhancing the public trail system in Town. Acquisition for land protection would become rare, and subsequent development would require densification of the Town and a corresponding loss of open space. Finally, it bears emphasis that local constraints, state regulations, and land ownership patterns can and do change. Protecting land with "permanent" conservation acquisition or restriction is important.

### E.3 Municipal Land of Importance

In addition to Town conservation land, Concord has over 50 parcels of land designated for municipal, school, cemetery or other purposes. The Town should continue to evaluate these municipal lands for designation as permanent conservation land, in whole or in part:

- The Town Recycling Facility, the former landfill, which is a core parcel of the large Walden Woods Natural Area should continue to be considered for conservation land to provide connectivity while maintaining existing municipal uses.
- Willow Guzzle on Sudbury Road is a valuable part of the large Nine Acre Corner Agricultural Area, as well as a key connector to diverse trails and natural areas on adjacent permanently protected land.
- White Pond Reservation includes important watershed protection for a well site within a larger context of open space and woodlands in both Concord and Sudbury, and protects the pond with its fragile aquatic ecosystem (see Water Resources Map). In addition, it abuts the potential north-south regional rail trail and provides important wildlife habitat and functions as a wildlife corridor.
- Peter Spring farm field by the wastewater treatment facility provides habitat for a state-listed rare species. Some of the area is used for organic farming and some may be needed for future sewage treatment facility expansion.

Other municipal lands are not a priority for permanent conservation land, though many portions of them should be managed for conservation purposes. Also, portions of some are suitable as, for example, small informal playing fields, neighborhood meeting places, farm fields, and so forth.

Lastly, both public and private parcels surrounding Town well sites should be identified for protection, in whole or in part. Such parcels help protect groundwater in the cone-of-influence around a well site by providing clean well water and conditions for natural aquatic ecosystems (see Public Water Supply Map). Future uses on these parcels should be identified and managed to ensure that resource values are protected.

### E.4 Ecologically Based Development

Evaluating the advantages and disadvantages of different house-lot sizes can help inform discussions about where potential growth is desirable and undesirable in Concord. More people can be accommodated in an area with smaller lots, it is important to determine the relative effects of large, medium, and small lot sizes on water, wildlife, recreation, and open space.

A large parcel (e.g. 2 acres or more) with one house commonly retains most ecological values relatively well. Groundwater is unlikely to become contaminated, much of the area remains a relatively natural habitat for biodiversity, and sufficient spaces exist between houses for most wildlife movement (even with a dog present at the house). Such large lots along the boundary of a major protected area may be a relatively effective way to buffer and help protect the area's valuable resources. However, properties with large lawns requiring significant fertilization do have the potential to impact and degrade ecosystems associated with those properties. Public outreach aimed to inform citizens of the detrimental effects of overwatering and fertilizer use can help reduce these issues.

Lots greater than two acres on prime agricultural soils may provide opportunities to individual property owners for agricultural use in the future, especially if food security becomes a problem with peak oil and climate change on the horizon. Protecting large lots from sub-division is one way that the Town can help prepare for the future.

At the other end of the scale, small building lots (e.g. 0.25 acre or less), form a fairly dense neighborhood providing relatively little ecological value. Still, such small lots may, for example, each provide sufficient living space, a small private space, and a vegetable garden for a family. Small lots within a half mile of amenities and public transportation also reduce car-dependence and help to reduce the carbon footprint of the Town.

Medium-size house lots (e.g., 0.5 to 2.0 acres) provide resources for relatively few people and can lead to extensive damage to the environment. At such densities, groundwater tends to accumulate diverse contaminants. The presence of domestic animals may impact wildlife by infringing on their habitat. Large lawns and their attendant lawnmowers, fertilizers, and significant water requirements are more common and negatively impact habitats and surface waters. Natural habitat is generally scarce, degraded, and fragmented. Planted and escaped exotic species are widespread. Road density and vehicular use are relatively high. As development density increases, extensive hard surfaces (e.g., roofs, driveways, sidewalks, roads) exacerbate surface-water runoff, with consequent high peak flows and/or flooding. An array of chemicals and sediments from lawns and roads is washed into streams, which are significantly degraded. With widespread septic systems, phosphorus, nitrogen and organic matter spread into groundwater and sometimes into surface water. Though the DPW has made strides in recent years in addressing these and other water-related issues, residents can take a proactive approach by managing these properties in a more sustainable manner.

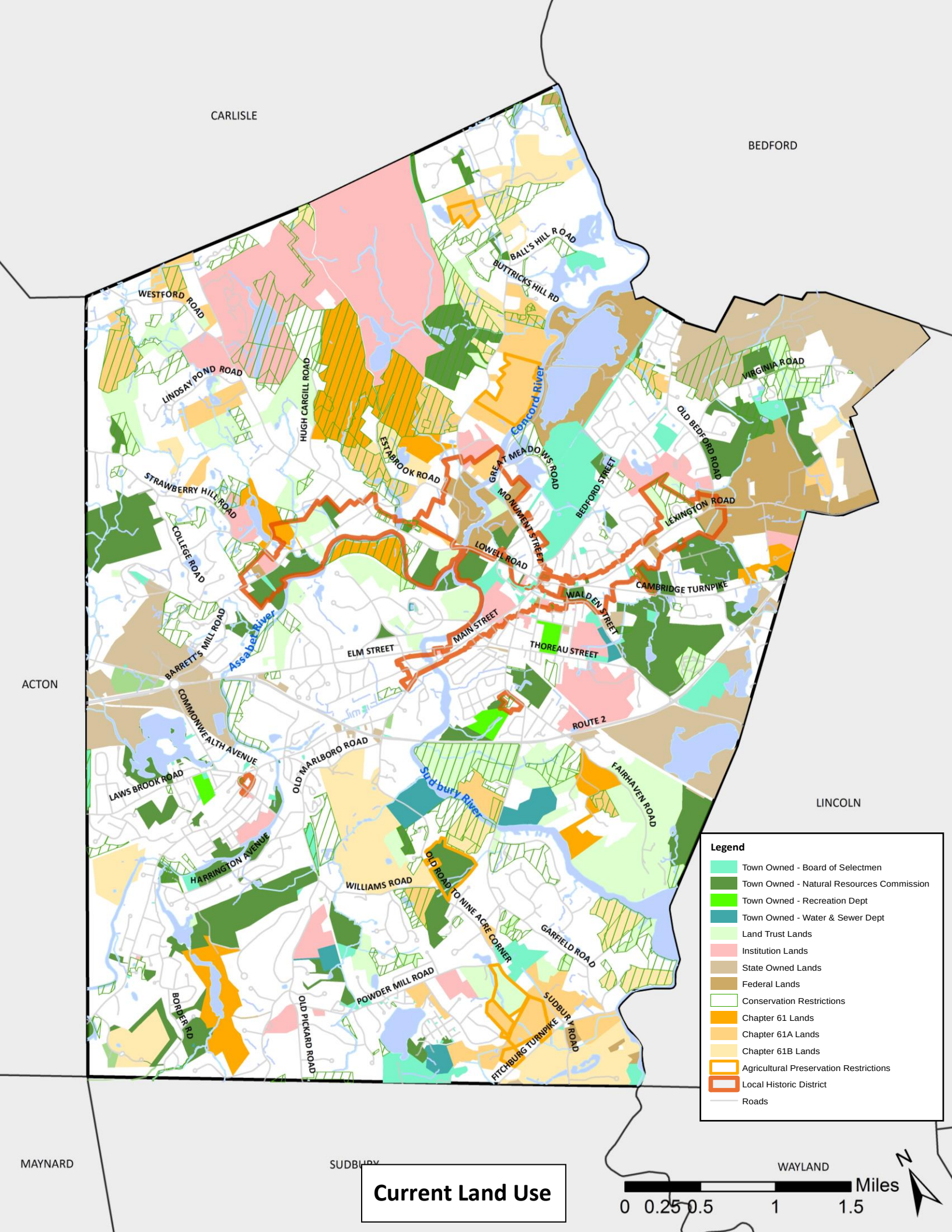
Before adding buildings in unbuilt areas, consideration of an increase in the number of people per building and/or the number of buildings per acre in areas of medium-size lots should be evaluated. In general, the Town should try to focus growth in areas served by sewers (which might require sewage treatment plant expansion) and other infrastructure. In addition, targeting growth within a convenient half-mile walking distance of the public-transport train stations would help minimize road and traffic effects on water, wildlife and open space.[14, 17] To help protect crucial large tracts such as Estabrook Woods, the Town Forest/Walden Pond/Fairhaven Hill area, and the National Park, large lots along their margins would be beneficial. Such approaches, based here upon open space and ecological criteria in Concord, are consistent with modern urban planning principles, including those of Metropolitan Area Planning Council (MAPC). In short, concentrating future growth in existing small and medium lot-size areas, especially those near the train stations and sewer infrastructure, and avoiding unbuilt areas, parcels adjoining major natural areas, and major water-protection and wildlife corridors, is strongly recommended.

MetroFuture, MAPC's 30-year plan for the region to support smart growth and regional collaboration include 13 implementation strategies: implementing coordinated plans; democratizing information; strengthening municipal finance; building regional collaboration; enabling smart growth; improving city life and school quality; protecting natural landscapes; expanding access to housing; supporting healthy families; investing in a skilled workforce; focusing economic growth; expanding coordinated transportation; and conserving natural resources. Concord employs many of these approaches through different initiatives. As these strategies relate to the OSRP, Concord strives to manage development to ensure the ecological integrity of its rivers, ponds, and wetlands is maintained to provide clean water for its residents while supporting healthy aquatic life and recreational opportunities. Specific initiatives include: sustaining native biodiversity by continuing to preserve large natural and agricultural areas, and water/wildlife corridors, while managing invasive species; increasing participation in the Community Preservation Act; providing strategies to adapt to climate change; increasing inter-municipal connectivity and collaboration; and supporting local farm production through the Agricultural Committee with the recent adoption of the Right to Farm Bylaw and creation of farm worker housing, to name a few.

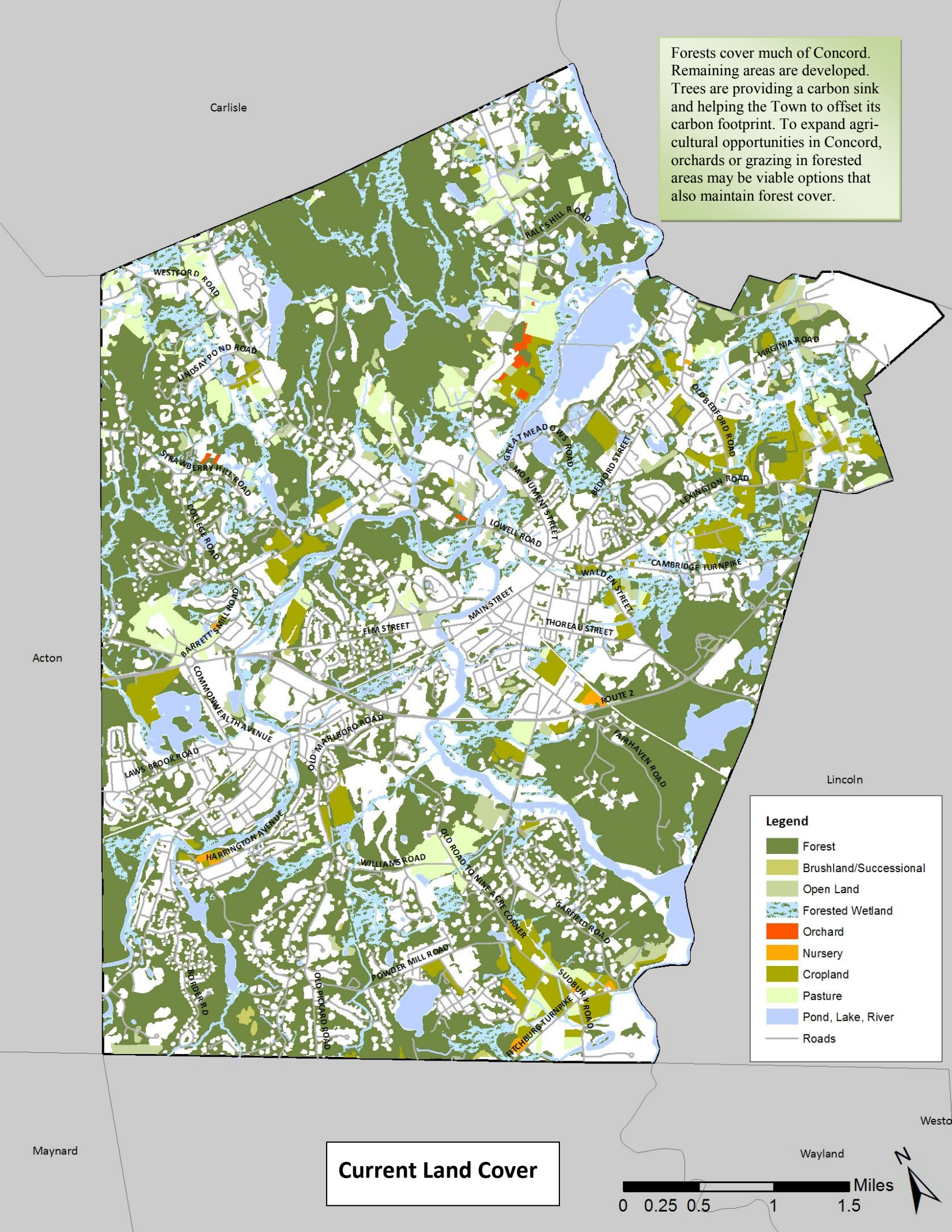
## Current Land Use

Concord's long history of agriculture is apparent in its landscape of open fields and wooded groves. Sites of historical importance owned by the Federal Government, State, and Town draw tourists to town and are permanently protected from development. Suburban development surrounds the two town centers in Concord and roughly follows a southwest to northeast pattern across town.

*Farmer's Cliff from Meadow*, by H. W. Gleason (undated).
Courtesy of the Concord Free Public Library




# Current Land Use


Forests cover much of Concord. Remaining areas are developed. Trees are providing a carbon sink and helping the Town to offset its carbon footprint. To expand agricultural opportunities in Concord, orchards or grazing in forested areas may be viable options that also maintain forest cover.
Carlisle
Acton
Lincoln
Maynard
Wayland
Westo
BALLS HILL ROAD
WESTFORD ROAD
LINDSAY POND ROAD
STRAWBERRY HILL ROAD
POLEGE ROAD
BARRETT'S MILL ROAD
COMMONWEALTH AVENUE
LAWS BROOK ROAD
HARRINGTON AVENUE
OLD MARLBORO ROAD
WILLIAMS ROAD
POWDER MILL ROAD
OLD PICKARD ROAD
HOSMER RD
OLD ROAD TO NINE ACRE CORNER
GARFIELD ROAD
SUDBURY ROAD
FITCHBURG TURNPIKE
ELM STREET
MAIN STREET
THOREAU STREET
WALDEN STREET
CAMBRIDGE TURNPIKE
LOWELL ROAD
MONUMENT STREET
GREAT MEADOWS ROAD
BEDFORD STREET
LEXINGTON ROAD
OLD BEDFORD ROAD
VIRGINIA ROAD
ROUTE 2
FAIRHAVEN ROAD
Legend
Forest
Brushland/Successional
Open Land
Forested Wetland
Orchard
Nursery
Cropland
Pasture
Pond, Lake, River
Roads
Current Land Cover
Miles
0 0.25 0.5 1 1.5
N

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